Management of Fingertip Amputations

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Learning Objectives

- Clarify the anatomy of the nail complex and finger pulp.
- State the epidemiology of fingertip injuries, including prevalence and distribution.
- Distinguish the different classifications of fingertip injuries and amputations.
- Elaborate on different treatment options of fingertip amputations from the least invasive to replantation.
- Review the treatment outcomes and complications of fingertip injuries.

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Injuries to the fingertips are among the most common injuries to the hand and result in approximately 4.8 million emergency department visits per year. Most injuries are lacerations or crushes; amputations represent a small but complex spectrum of injury. Treatments available cover a broad range of techniques with no single recommended reference standard for treatment. Although there is no consensus on how these injuries should be treated, the goals of treatment should include minimization of pain, optimization of healing time, preservation of sensibility and length, prevention of painful neuromas, avoidance or limiting of nail deformity, minimization of time lost from work, and provision of an acceptable cosmetic appearance. In this review we present a variety of options in caring for these injuries to help achieve these goals, and the available data that support the various treatment plans. *(J Hand Surg Am. 2014;39(10):2093–2101. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Fingertip, amputation, injury, replantation, classification.

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The fingertip is a specialized structure that allows fine motor activity and sensation during prehension, and also contributes to the aesthetics of the hand. As the first portion of the upper extremity to interact with the environment during exploratory and manipulative functions, the fingertip is particularly vulnerable to injury. Fingertip injuries affect soft tissue, bone, or nail distal to the insertions of the long digital flexor and extensor tendons of the fingers or thumb. Most fingertip injuries are lacerations or crush injuries; amputations represent a small but complex spectrum of injury with no single recommended reference standard for treatment. However, suboptimal management can result in persistent pain, abnormal sensation, nail deformity, joint stiffness in the involved digit, and reduced grip strength.

ANATOMY

The fingertip is composed of multiple specialized structures (Fig. 1), all of which must be considered when evaluating and treating injuries. The nail is a prominent feature of the fingertip and fulfills a functional role by protecting the dorsal surface of the phalanges, improving sensory perception, facilitating pinch, and making scratching possible.[1] In addition, the fingernail has a cosmetic role. The nail complex itself is divided into specific parts: nailbed, nail plate, eponychium (cuticle), perionychium, and hyponychium. The nailbed consists of 2 parts: the proximal germinal matrix and the distal sterile matrix. The junction between these 2 parts is defined by the lunula. Only the germinal matrix produces ungula keratin; the sterile matrix's main function is nail plate adherence. The absence of dermis and subcutaneous tissue between the nail matrix and the underlying distal phalanx may increase the risk for osteomyelitis after open injuries. The nail plate is composed of onchyn, a keratinous substance produced by the death of the germinal cells as they are pushed upward from the germinal matrix. The proximal portion of the nail plate, concealed under the eponychium, is often referred to as the nail root. The eponychium and paronychium form the proximal and lateral soft tissue borders of the nail, respectively. The hyponychium is a plug of keratinous material situated beneath the distal edge of the nail where the nailbed meets the skin. The rate of nail longitudinal growth depends on the patient's age, sex, and habits; it averages 0.1 mm/d.

The epidermis of the fingertip is thick with deep papillary ridges that produce unique fingerprints. The deeper pulp consists of multiple fibrous bands extending from the dermis to the periosteum of the distal phalanx, the bony core of the fingertip, creating a latticework of separate septal compartments containing fat. The pulp constitutes over half of the fingertip volume and its intimate association with the underlying bone via the septa has a crucial role in grip.

Arborization of the digital arteries and nerves to the fingertip occurs near the distal interphalangeal (DIP) joint, where the nerve lies volar to the artery. The proper digital artery sends a branch to the nailfold, nailbed, and pulp. Each digital nerve sends a branch to the paronychium, tip of the finger, and pulp. As the primary organ of touch, the fingertip is abundantly supplied with sensory receptors including Pacinian and Meissner corpuscles, and Merkel cell neurite complexes.

EPIDEMIOLOGY

Injuries to the fingertips are among the most common ones to the hand, accounting for 4.8 million emergency department visits per year.[2] In the pediatric population fingertip injuries account for two thirds of all hand injuries, with the most common mechanism of injury being a crush between a door and its frame.[3,4]

In contrast, in adults lacerations predominate, followed by crush and avulsion injuries. The most commonly involved digits are the index finger, thumb, and middle finger. The nondominant hand is most frequently involved and most injuries involve a single digit.

DIAGNOSIS

In addition to patient-related factors such as age, hand dominance, general health, occupation, and hobbies, the history should also include the time and mechanism of injury. Any conditions that could compromise regional blood flow and thereby limit reconstructive options, such as diabetes, tobacco use, or vasospastic disorders, should be duly noted. The injured finger should be evaluated to determine size, location, and geometry of any pulp defect, degree of nailbed involvement, and the presence or absence of exposed bone. After sensory evaluation, a more thorough examination may require analgesia and establishment of a bloodless field. A digital block will usually be adequate but in select individuals this may require supplementation with opioids. Local anesthetic may safely be used for this block with or without epinephrine.[5] Radiographs should be obtained of the injured finger, and also of the amputated part if replantation is being considered.

To facilitate documentation and treatment planning during evaluation of fingertip amputations, several